CLAIMS:

1   A system for fingerprint authentication, which comprises:

5   which stores, regenerates, or matches shape of curves, by using a specified group of data in length and/or angle and/or position to express a shape of curve, in said system using sequence of several measure points on the curve, which are determined so as to make the same distances between those adjacent measure points, the data of lengths of arcs being between starting measure point and ending measure points among every 3 consecutive measure points on the curve.

15   2.   The system as in claim 1 for recognition of curve expressed on the periodic discrete grids such as digital image, which determines position of measure points by interpolating positions of two nearest adjacent grids on the curve, whose distances from starting measure point are less and greater than the specified value, respectively.

3.   A system as in claim 1 for fingerprint authentication, comprising a sequence of processing:
means for block partitioning to partition whole image data into plural pieces of blocks.
means for the first binarization to make gray scale image a binary black and white image by enhancing contrast of original image.
means for deriving directions of ridge in binary image.
means for noise elimination to eliminate black data not located along directions of ridge.
means for the second binarization to make gray scale image a binary data by enhancing contrast of original images.

means for thinning by reducing width of ridge until ridge width becomes one pixel in size.

means for false minutia elimination to eliminate plural minutia located closely to each other, ending minutia located near bifurcation minutia, minutia located closely to image boundary, and isolated minutia without ridge, and

means for extracting minutia to adopt remaining minutia as true minutia after above false minutia elimination.

4.   A system as in claim 1 wherein it utilizes, as a additional feature of fingerprints, both said minutia ridge shape and said ridge shape of secondary minutia, whose position is determined in associated with each minutia.

5.   A system as in claim 3, wherein two kinds of extraction means for ending minutia are performed over original black and white image and its reversed black, instead of extracting both ending and bifurcation minutia over original black and white image.

6.   A system as in claim 1, wherein it includes a cost effective calculation for judging true or false minutia, comprising:

means for taking 2 dimension coordinates with an origin of a bifurcation point.

means for taking 3 points on different ridges leaving from the bifurcation point with the same distances from the bifurcation point.

means for calculating all inner products of 2 point vector selected from said 3 points, wherein inner product means sum of multiplication of horizontal components of said 2 points with each other and multiplication of vertical components of said 2 points with each other.

means for judging the bifurcation as a false bifurcation minutia if all 3 said inner products are less than a specified value. Otherwise, judging the bifurcation as a true bifurcation minutia.

5   means for judging ridge ending as a false ending minutia by using the similar inner products over valleys if all 3 said inner products are less than a specified value. Otherwise, judging the ending as a true ending minutia.

10   7. A system for fingerprint authentication as in claim 1, wherein under assumption of consecutive frame inputs of identical fingerprints, a different part of fingerprint image is processed in said way to generate numerical data for each frame input of fingerprint image
15 and processing of a whole fingerprint image is completed for plural frame inputs of fingerprint image.

      8. A system for fingerprint authentication, wherein it uses means of judge on fingerprint verification
20 without compensation for displacement of input fingerprint image, comprising
      means for employing memory area in 2 dimensional coordinates for judge.
      means for calculating a similarity measure for each pair
25 of minutia data between input fingerprint image and registered template fingerprint.
      means for accumulating the similarity measure in the memory area, whose coordinates are the same as vectors between the positions of the said 2 minutia. The similarity
30 measure means any numerical data to express similarity between 2 minutia.
      means for judging input fingerprint as the same registered one if the maximum value in memory area exceeds a specified value.
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9. A curve recognition system or means for fingerprint authentication, wherein it is robust against any rotation and displacement of input fingerprint image, comprising,

means for rotating coordinates of all minutia with a rotation angle around a specified origin.

means for compensating minutia ridge shape for rotation of the said same angle. means for employing fingerprint matching method without compensation of displacement of fingerprints as in claim 10.

10. A curve recognition system as in claim 7, wherein under assumption of consecutive several frame inputs of identical fingerprint, it takes 6th of 25 seconds to complete processing from image capture to numerical processing, which corresponds to input time of 6 or 7 frames.

11. A system as in claim 1 for fingerprint authentication, comprising

means for extracting said numerical data of said fingerprint ridge shapes of ridge leaving from said minutia.

means for matching numerical data with template samples registered in advance or database in said way.

12. A system as in claim 1, wherein on 100 MOPS computer, it performs a sequence of processing as said thinning, said improvement or said compensation, said binarization, said thinning, said collection and said matching of fingerprint feature data expressed by 40 or 60 bytes data in size. MOPS means unit of operation speed of computer, which represents million operations in one second.

13. A system as in claim 1, comprising

means for extracting said fingerprint feature data of 40 or 60 bytes from said fingerprint template transferred from outer device or terminal equipment.

means for transferring result of matching with said templates through communication network to outer device or terminal equipment.

14 A system as in claim 1, wherein it is used with terminal or stand-alone equipment, which posses a function such as search for personal history, key lock, issue of various tickets, access control and toll of gates, electric commerce, and fund management in medical, social welfare, service, public service, and financial organization.

15   A system as in claim 1, wherein it is embedded in hardware or software as a part of design data protection. To use the hardware or software requires personal authentication with fingerprints.

16 A system as in claim 1, wherein criteria of acceptance is decided by logic operations among extracted feature data of plural fingerprints.